2-8 also should be allowable as they depend from claim 1. This amendment is introduced for purposes of clarity and not patentability.

Rejection under 35 U.S.C. §103

Claims 1-8 are rejected under 35 U.S.C. §103(a) as being anticipated by Merritt in view of Osinski *et al.* The Office Action states that:

> Merritt teaches a diode laser comprising a plurality of semiconductor layers ... a dopant region ... [and] means facilitating application of an electric field. Merritt fails to teach the ridge having both an elongated and a flared segment. Osinski *et al.* teach the ridge comprises an elongated segment and a flared segment extending to the first edge, the flared segment comprising at least two opposed grooves in a surface thereof, the grooves suppressing multimode radiation, see figs 1 and figs 3-5. It would have been obvious to one of ordinary skill in the art at the time the invention was made to employ the teachings of Osinski *et al.* to the laser of Merritt in order to improve the laser power output performance ....

The Applicants teach in claim 1, amended herein:

> A diode laser comprising: a plurality of semiconductor layers including a top layer, a bottom layer, and an intermediate emission layer, the top layer including a ridge formed on a top surface thereof and extending to a first edge of the top layer ... a dopant region contained by the ridge; means facilitating application of an electric field ... wherein the ridge comprises an elongated segment and a flared segment extending to the first edge, the flared segment comprising at least two opposed grooves in a surface thereof, the grooves suppressing multimode radiation.

As stated in M.P.E.P. §2143.01, the mere fact that references can be combined does not render the resultant combination obvious unless the prior art suggest the desirability of the combination. M.P.E.P. §2143.01 further explains that the proposed modification cannot change the principle of operation of the prior art invention being modified. The Abstract of Merritt recites in part, "The mode converter efficiently couples output from an active single mode waveguide to two or modes of a multilateral mode waveguide." The Specification of Osinski *et al.* teaches that:

> [i]t is a primary object of this invention to provide a means for maintaining the optical power density at the rear end facet of a semiconductor optoelectronic device at a level below that which leads to COD while retaining the single spatial mode filtering properties of the linear or straight single mode portion of the device. (Column 1, lines 57-62.)

Thus, Merritt teaches an optical waveguide that generates multi-mode radiation, whereas the object of the invention of Osinski *et al.* is to suppress multi-mode radiation. Instead of suggesting the desirability of the combination, the cited references actually teach away from it; indeed, their teachings are antithetical and cannot be combined as the Examiner proposes. Accordingly, Applicants submit that the combination of the cited references is improper and respectfully request that the Examiner reconsider and withdraw the obviousness rejection under 35 U.S.C. §103.

Moreover, even apart from the propriety of combining Merritt with Osinski *et al.*, Osinski *et al.* fail to teach that "the ridge comprises an elongated segment and a flared segment extending to the first edge, the flared segment comprising at least two opposed grooves in a surface thereof, the grooves suppressing multimode radiation," as the Office Action asserts. To maintain lowest order spatial mode operation in their optoelectronic devices, Osinski *et al.* utilize a narrow strip of index-guided region 18, 48, 49, and 69 in Figures 1, 3, 4, and 5 respectively. (Column 3, lines 37-39; column 5, lines 33-35; column 6, lines 29-32; and column 6, lines 38-40.) Referring to Figure 5, Osinski *et al.* teach:

> [b]etween region 69 and output facet 62 is a tapered region 50 that includes a *patterned pumping stripe* 72 through its entire length for the purpose of permitting the propagating light to expand in region 70 to output aperture 63 but without receiving significant gain from pumping via stripe pattern 72. Region 70 is gain guided .... (Column 7, lines 9-14; emphasis added.)

The *patterned pumping stripe*, which the Examiner apparently equates to the grooves in the Applicants' invention, suppresses laser gain, and therefore uniformly, but not selectively, *suppresses both single mode and multimode laser radiation*. In contrast, the *opposed grooves* taught in claim 1 of the present application *suppress multimode radiation only.*

Accordingly, Applicants respectfully submit that claim 1 is allowable because neither Merritt nor Osinski *et al.*, alone or in combination, teaches or even suggests the recited limitations. Furthermore, Applicants respectfully submit that claims 2-8 are allowable as depending from claim 1.

CONCLUSION

In view of the above remarks, reconsideration of the amended claims and withdrawal of the rejections is respectfully requested. Applicants submit that all claims are now allowable. If the

Examiner believes that a telephone conference with Applicants' attorney would be helpful, the Examiner is invited to contact the Applicants' attorney at the number below.

Respectfully submitted,

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MARKED-UP VERSION OF THE AMENDED SPECIFICATION

The present invention provides a laser-diode structure whose output is largely single-mode. This is achieved by using a ridged top layer that defines the amplification region within the underlying emission layer, and which is provided with grooves that suppress the higher modes. As shown in FIGS. 2A and 2B, a representative structure 200 includes a first, second, and third semiconductor layers 205, 210, 215, respectively, which form a diode laser as described above. The top layer 215 is provided with a ridge 220 that extends from the rear edge 222 of layer 215 to the front edge 225 thereof. The ridge has an elongated, narrow segment 240 and a flared segment 250 that terminates at the front edge 225. The ridge 220 also contains a doping material (e.g., a rare earth element as discussed above), and a complementary doping material 265 is applied to the bottom surface of layer 205 in a pattern identical to the shape of ridge 220, and in direct opposition thereto. The entire top surface of layer 215 (including the exposed surfaces of ridge 220) and the entire bottom surface of layer 205 are metallized to form electrical contacts 270.

MARKED-UP VERSION OF AMENDED CLAIMS

What is claimed is:

1. (AMENDED) A diode laser comprising:

a. a plurality of semiconductor layers including a top layer, a bottom layer, and an intermediate emission layer, the top layer including a ridge formed on a top surface thereof and extending to a first edge of the top layer, the layers each having a refractive index associated therewith, the refractive index of the emission layer differing from the refractive indices of the top and bottom layers;

b. a dopant region contained by [associated with] the ridge [and conforming in shape thereto];

c. means facilitating application of an electric field through the layers, the electric field altering the refractive indices of the layers, the degree of alteration differing within a confinement region defined by the ridge, radiation generated within the emission layer being optically confined within the confinement region and emitted from a first edge of the emission layer;

wherein

d. the ridge comprises an elongated segment and a flared segment extending to the first edge, the flared segment comprising at least two opposed grooves in a surface thereof, the grooves suppressing multimode radiation.

2. (AMENDED) The diode laser of claim 1 [wherein the ridge contains a dopant material, and] further comprising a dopant material on an exposed surface of the bottom layer in a pattern identical in shape to the ridge.